

ARC-15088-1

2

PATENT

Amendments to the Claims:

1 (currently amended). A system for enclosing a biological ~~insert, such as cells or tissues or group of cells~~ for positioning within ~~a selected an~~ ambient medium, the ~~method~~ system comprising:

~~enclosing a selected biological insert in a cage or envelope of a cage material that includes primarily carbon nanotube Bucky paper ("CNTBP"), the cage having a selected at least one of a cage thickness in a range 1-100 μm and a cage area density in a range of 420-1500 μgm/cm², where the cage encloses at least one of a biological tissue or a group of cells (referred to herein as a "biological insert") and an interior of the cage is substantially isolated from an ambient medium surrounding the cage, except for transport a molecule of at least one selected molecule species of molecule between the cage interior and the ambient medium.~~

2 (original) The system of claim 1, wherein said cage is used to grow said biological insert without provoking a substantial immunological response from said ambient medium.

3 (currently amended). The system of claim 1, wherein said cage is used to place cells derived from a ~~selected~~ cell culture into a ~~selected~~ biological host without provoking a substantial immunological response from ~~said ambient medium the biological host.~~

4 (currently amended). The system of claim 1, wherein said cage is used to place at least one of a bacterial cell, a yeast cell, a mammalian cell and a non-mammalian cell into a ~~selected~~ biological host without provoking a substantial immunological response from ~~said ambient medium the biological host.~~

ARC-15088-1

3

PATENT

5 (original). The system of claim 1, wherein said biological insert includes at least one cell that is capable of cell differentiation and said cage promotes cell differentiation by the at least one cell without provoking a substantial immunological response from said ambient medium.

6 (currently amended). The system of claim 1, wherein said cage is modified by addition of ~~a selected an~~ active biological substance to an said interior of said cage.

7 (original). The system of claim 6, wherein said active biological substance is selected to be at least one of a protein, a peptide, a polypeptide, a growth factor, a cytokine, a nucleic acid and a nucleic acid polymer.

8 (original). The system of claim 6, wherein said active biological substance is added to said cage interior by at least one of: non-specific adsorption, covalent coupling and chemical cross-linking so that said active biological substance becomes entangled with said CNTBP cage material.

9 (currently amended). The system of claim 6, wherein said active biological substance is added to said cage interior by attachment to a ~~selected~~ bead so that the bead and said attached active biological substance cannot be transported from inside said cage to outside said cage.

10 (original). The system of claim 6, wherein said cage interior, modified by said addition of said active biological substance enhances at least one process of: growth, differentiation, de-differentiation, assembly into a two-dimensional cell

ARC-15088-1

4

PATENT

structure, and assembly into a three-dimensional cell structure, of said biological insert.

11 (currently amended). The system of claim 1, wherein said cage is modified by ~~addition of a selected at least one of covalent attachment an active~~ biological substance to an exterior of said cage and adsorption of the active biological substance to the exterior of said cage.

12 (original). The system of claim 11, wherein said active biological substance is selected to be at least one of a protein, a peptide, a polypeptide, a growth factor, a cytokine, a nucleic acid and a nucleic acid polymer.

13 (original). The system of claim 11, wherein said cage exterior, modified by said addition of said active biological substance enhances immune shielding by said cage.

14 (currently amended). The system of claim 1, wherein said biological insert includes at least one cell that is capable of cell differentiation and said cage suppresses cell differentiation by the at least one cell without provoking a substantial immunological response from ~~said ambient medium a biological host that contains said cage.~~

15 (original). The system of claim 1, wherein said cage is used to transplant said biological insert from a first organism to a second organism without provoking a substantial immunological response from at least one of the first organism and the second organism.

ARC-15088-1

5

PATENT

16 (currently amended). The system of claim 1, wherein said cage is used to transplant said biological insert from a first region of a host body to a second ~~region~~ region of the host body without provoking a substantial immunological response from the host body.

17 (original). The system of claim 1, wherein said cage has at least two adjacent layers of said CNTBP material and substantially has a shape drawn from a class of cage shapes consisting of a cylinder, a torus and a multiple-sheet structure.

18 (original). The system of claim 1, wherein said cage is chemically modified by addition of at least one of a hydride, a nitride, an oxide, a halide, a sulfide, a protein, and a peptide to said cage material.

19 (currently amended). A system for providing secretion of an active biological substance into ~~a selected~~ an ambient medium, the system comprising:

~~a selected~~ an active biological substance enclosed in a cage or envelope of a cage material that includes primarily carbon nanotube Bucky paper ("CNTBP"), having ~~a selected~~ at least one of a cage thickness in a range 1-100 μm and a cage area density in a range of 420-1500 $\mu\text{gm}/\text{cm}^2$, where an interior of the cage is substantially isolated from an ambient medium located in an exterior of the cage, except for transport of ~~at least one selected~~ molecules of at least one species between the cage interior and the cage exterior, and where the active biological substance has a positive rate of transfer across the cage material from the cage interior to the cage exterior.

ARC-15088-1

6

PATENT

20 (currently amended). The system of claim 19, wherein said cage further encloses at least one of a thyroid tissue or portion of a thyroid gland and said cage permits transfer of a thyroid hormone or other iodine-containing compound that includes iodine from inside said cage to outside said cage.

21 (currently amended). The system of claim 19, wherein said cage further encloses at least one of a pancreas tissue or portion of a pancreas gland and said cage permits transfer of a pancreas hormone or other insulin-containing compound that includes insulin from inside said cage to outside said cage.

22 (original). The system of claim 19, wherein said cage is chemically modified by addition of at least one of a protein, a peptide and a molecule including at least one of a hydrogen atom, an oxygen atom, a nitrogen atom, a sulfur atom, a fluorine atom, a chlorine atom, a bromine atom and an iodine atom to said cage material.

23 (currently amended). A method for providing secretion of an active biological substance into a selected an ambient medium, the method comprising:

enclosing a selected active biological substance at least one of a tissue and a group of cells (referred to herein as a "biological insert"), having a capability of secreting a selected chemical and having a selected active substance an insert first concentration, in a first cage or envelope of a first cage material that includes primarily carbon nanotube Bucky paper ("CNTBP"), having a selected at least one of a cage thickness in a range 1-100 μm and a cage area density in a range of 420-1500 $\mu\text{gm}/\text{cm}^2$, where the active biological substance insert has a positive rate of transfer across the first cage material from a first cage interior to a first cage exterior; and

ARC-15088-1

7

PATENT

enclosing ~~the active~~ a second biological substance insert, having ~~a selected~~ active substance an insert second concentration, in a second cage or envelope of a second cage material, having a ~~selected~~ second cage thickness, where an interior of the second cage is contained within the first cage and where the ~~active~~ second biological substance insert within the second cage has a positive rate of transfer across the second cage material from a second cage interior to the first cage interior.

24 (original). The method of claim 23, further comprising enclosing within said second cage at least one of a thyroid tissue and a portion of a thyroid gland.

25 (original). The method of claim 23, further comprising enclosing within said second cage at least one of a pancreas tissue and a portion of a pancreas gland.

26 (original). The method of claim 23, further comprising chemically modifying said cage by addition of at least one of a protein, a peptide and a molecule including at least one of a hydrogen atom, an oxygen atom, a nitrogen atom, a sulfur atom, a fluorine atom, a chlorine atom, a bromine atom and an iodine atom to said cage material.

27 (currently amended). A method for monitoring at least one of presence and concentration of an active biological substance in ~~a selected~~ an ambient medium, the method comprising:

enclosing a ~~selected~~ monitoring substance, which reacts with a ~~selected~~ monitored substance and undergoes at least one of a chemical change and a physical change, in a cage or envelope of a cage material that includes primarily

ARC-15088-1

8

PATENT

carbon nanotube Bucky paper ("CNTBP"), the cage having ~~a selected at least one of a cage thickness in a range 1-100 μm and a cage area density in a range of 420-1500 μgm/cm²~~, where an interior of the cage is substantially isolated from an ambient medium located in an exterior of the cage and where the monitored substance has a positive rate of transfer across the cage material between a cage exterior and a cage interior; and

when the monitoring substance undergoes at least one of the chemical change and the physical change, the system interprets this condition to indicate that the monitored substance is present in the ambient medium.

28 (canceled).

29 (original). The method of claim 27, further comprising chemically modifying said cage by addition of at least one of a protein, a peptide and a molecule including at least one of a hydrogen atom, an oxygen atom, a nitrogen atom, a sulfur atom, a fluorine atom, a chlorine atom, a bromine atom and an iodine atom to said cage material.

30 (currently amended). A method for controlling activity of a biological ~~insert~~ tissue or group of cells in a host body, the method comprising:

enclosing a ~~selected~~ biological tissue or group of cells (referred to herein as a "biological insert") that is initially in an inactive state, in a cage or envelope of a cage material that includes primarily carbon nanotube Bucky paper ("CNTBP"), the cage having ~~a selected at least one of a cage thickness in a range 1-100 μm and a cage area density in a range of 420-1500 μgm/cm²~~, where an interior of the cage is substantially isolated from an ambient medium located in an exterior of the cage; and

ARC-15088-1

9

PATENT

at a ~~selected~~ first time, administering a ~~selected~~ triggering agent to at least one of the ambient medium and the cage interior to activate the biological insert and to permit at least part of the activated biological insert to ~~pass from the cage interior to ambient medium~~ secrete an active biological substance within the cage.

31 (currently amended). The method of claim 30, further comprising administering, at a second ~~selected~~ time subsequent to said first ~~selected~~ time, a second ~~selected~~ triggering agent to at least one of said ambient medium and said cage interior to deactivate said activated biological insert that is located in at least one of said cage interior and said ambient medium.

32 (original). The method of claim 30, further comprising chemically modifying said cage by addition of at least one of a protein, a peptide and a molecule including at least one of a hydrogen atom, an oxygen atom, a nitrogen atom, a sulfur atom, a fluorine atom, a chlorine atom, a bromine atom and an iodine atom to said cage material.

33 (currently amended). A method for providing a medical device within a host body, the method comprising:

enclosing a ~~selected~~ medical device in a cage or envelope of a cage material that includes primarily carbon nanotube Bucky paper ("CNTBP"), having a ~~selected~~ at least one of a cage thickness in a range 1-100 μm and a cage area density in a range of 420-1500 μgm/cm², where an interior of the cage is substantially isolated from an ambient medium surrounding the cage, except for transport of ~~at least one selected~~ a molecule of at least one species between the cage interior and the ambient medium, where the cage material acts as a shield to

ARC-15088-1

10

PATENT

prevent ~~selected~~ molecules, other than the at least one species molecule, in the ambient medium from contacting the device;

when the medical device is initially inactive, providing a medical device activation signal that activates the device at ~~a selected~~ an activation time; and

when the medical device is initially active, providing a medical device inactivation signal that inactivates the device at ~~a selected~~ an inactivation time.

34 (currently amended). The method of claim 33, further comprising selecting said medical device to be a nano-device that provides or transforms at least one of a ~~selected~~ chemical and a ~~selected~~ signal within said cage.

35 (currently amended). The method of claim 33, further comprising selecting said medical device to be a macroscopic device that provides or transforms at least one of a ~~selected~~ chemical and a ~~selected~~ signal within said cage.

36 (original). The method of claim 33, further comprising providing at least one of said activation signal and said inactivation signal as at least one of a chemical signal, an optical signal, an electronic signal, an electromagnetic signal, an ultrasound signal and a mechanical signal that is initially produced outside said cage, passes through said cage material, and interacts with said medical device.

37 (currently amended). The method of claim 33, further comprising:

when said medical device is initially active, providing a medical device control signal that changes at least one operating parameter for said medical device at a ~~selected~~ control time.

ARC-15088-1

11

PATENT

38 (original). The method of claim 37, further comprising providing at least one of said activation signal and said inactivation signal as at least one of a chemical signal, an optical signal, an electronic signal, an electromagnetic signal, an ultrasound signal and a mechanical signal that is initially produced outside said cage, passes through said cage material, and interacts with said medical device.

39 (new). The system of claim 6, wherein said active biological substance is produced by said biological insert within said cage.

40 (new). The system of claim 39, wherein said active biological substance enhances at least one of the following processes associated with said biological insert: growth, differentiation, de-differentiation, assembly into a two-dimensional cell structure, and assembly into a three-dimensional cell structure.

41 (new). The system of claim 1, wherein said cage is modified by at least one of covalent attachment an active biological substance to an exterior of said cage and adsorption of the active biological substance to the interior of said cage.

42 (new). The system of claim 1, wherein said biological insert includes at least one cell that is capable of cell differentiation and said cage promotes cell differentiation by the at least one cell without provoking a substantial immunological response from a biological host that contains said cage.

43 (new). The method of claim 30, further comprising choosing said active biological substance from the group of substances consisting of insulin, cytokines and biological response modifiers.